PhD. SYNOPSIS

IMPACT OF NUTRITION INTERVENTION AND DRESS CODE ON VITAMIN D NUTRITURE OF MUSLIM WOMEN

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INRODUCTION

Vitamin D belongs to the group of fat soluble vitamins and it is very essential for the metabolism and health outcomes such as bone mineralization and immune function. Vitamin D can be provided through dietary intake, medicinal supplements and synthesized as pro-hormones by exposure of the skin to Ultra Violet B rays from sunlight via a process similar to photosynthesis in plants [1,2]. Sunlight is the major (90%) source of Vitamin D and it is estimated that sunlight exposure on bare skin for 5 to 10 minutes thrice a week can produce sufficient Vitamin D [3]. Vitamin D predominantly exists in two different forms Vitamin D_2 (Ergocalciferol) a plant sterol and Vitamin D_3 (Cholecalciferol) the form produced in animals and human of which the later is found to be a more potential source of Vitamin D [4]

Vitamin D has may skeletal and non skeletal functions in our body. The non skeletal benefits such as prevention of Diabetes mellitus, cardiovascular diseases, multiple sclerosis, cancer, renal diseases and improving immunity has been uncovered with the discovery of the Vitamin D receptors in various tissues and cells [5] Currently its role in women health for fertility, pregnancy, lactation and menopause has been brought into light, making it as an essential nutrient to support different stages in a women's life[6,7]. With all these benefits, Vitamin D deficiency has still manifested as a global pandemic, it is the most under tested and under treated issue in existence. Literature review has suggested association between long term low Vitamin D levels and development of chronic diseases [8]. Research on Vitamin D status of Indians has suggested high prevalence of Vitamin D deficiency in women (70%) compared to men in spite of ample availability of sunlight in India [9]

Globally, muslim women follow unique lifestyle practices as instructed in the Quran. This lifestyle can be a contributing factor in Vitamin D deficiency. Studies conducted in the middle east countries where abundant Muslim population live, ample and sunlight is available has shown women to have very low levels of Vitamin D indicating some contributing factors other than availability of sunlight [10]. In Morocco, among 415

Muslim women studied, 91 per cent had moderate levels of Vitamin D. In Saudi Arabia, Vitamin D deficiency was predominant among women of all ages [11] In Delhi, India, pregnant women wearing burqa had high levels of Vitamin D deficiency and it was associated with adverse maternal and foetal outcomes [12]. Further studies on awareness about Vitamin D conducted in India showed lack in awareness regarding sources and importance of Vitamin D [13]. Decreased awareness levels can also be a cause of low Vitamin D status.

As such many factors can contribute to deficiency among Muslim women, it is important to identify these factors and provide solutions in order to prevent the risk of Vitamin D deficiency among these women. Lifestyle of Muslim women in South India varies as it has regional influences along with cultural influences. Not many studies has been conducted on Muslim women in Coimbatore, a South Indian city in Tamilnadu. Hence, the present study is centered on studying lifestyle pattern, cultural practices and dress code, its effect on Vitamin D status of Muslim women and to provide sustainable intervention to maintain Vitamin D status through digital health intervention and one to one telephonic counseling with dietary modification and to evaluate the effectiveness of intervention.

CHAPTER SCHEME

CHAPTER 1 – INTRODUCTION

Introduction to Vitamin D, Importance of Vitamin D, Vitamin D deficiency, Prevalence of deficiency, lifestyle pattern of Muslim women, awareness about Vitamin D, Vitamin D status of Muslim women, intervention study comparing effectiveness of digital intervention and one to one telephonic counselling with dietary modification, rational of the study and objectives are discussed in this chapter.

Objectives of the present study

Primary objectives

- Elicit information on the socio economic status and life style pattern of Muslim women
- Study their health and nutritional status with reference to Vitamin D

- Assess their knowledge on Vitamin D
- Impact evaluation of intervention

Secondary objectives

- Identify the factors influencing Vitamin D nutriture among Muslim women
- Determine their Vitamin D intake
- Study availability of Vitamin D fortified foods
- Develop intervention modules and implement on selected Muslim Women

CHAPTER II -REVIEW OF LITERATURE

This chapter comprises of literature on lifestyle pattern and cultural practices of Muslim women, Health and Nutritional status of Muslim Women, Vitamin D nutriture, Vitamin D deficiency among Muslim Women and Digital health intervention.

CHAPTER III – METHODOLOGY

The study was conducted in VII phases as follows:

PHASE I - SELECTION OF AREA AND SUBJECTS

Coimabatore, a city in Tamilnadu was selected for the study to evaluate the impact of intervention on Vitamin D status of Muslim women. Not many studies has been carried out on Vitamin D status of Muslim women in this area. Pothanur, Athuplam, Karumbukadai, Alameen colony, Sivananda colony, Marakadai and Town hall where majority of Muslim population live were selected for the study. The sample size was calculated applying Yamame formula [14] to the last census data (398). The subjects selected for the study were Muslim women between 20 to 45 years of age. This age group was selected as it is the reproductive age and intervention during this age can prevent development and progression of health issues in women.

PHASE II - COLLECTION OF BACKGROUND DATA:

Five hundred and ninety subjects were included in the study by purposive sampling method. The inclusion criteria for the subjects was Muslim women of age group 20 to 45 yrs and the exclusion criteria were women from other community, age groups less than

20 and more than 45 years, pregnant and lactating women. After selection of area and subjects, a no objection letter was obtained from the Coimbatore Jamath head incharge of the Muslims "Jamath-e-Islamia Hind". Prior to the data collection, written consent was obtained from the subjects and ethical clearance was obtained from the Institutional Human Ethics committee (certificate no.: AUW/IHEC-18-19/FSN/FHP-08). To conduct the study, background data on socio economic status, health status, cultural habits, dietary pattern, lifestyle pattern, physical activity pattern and awareness about Vitamin D were collected with the help of a structured well designed interview schedule. Data was collected by door to door and face to face interview.

PHASE III - MARKET SURVEY:

A market survey was conducted in and around the areas selected for the study. Shops were selected by purposive sampling method, they were categorized into petty shops, grocery stores, departmental stores and online stores. Prior permission was obtained from the shop owners. Fortified foods were identified and data on the percentage of fortification was collected from the food labels. Seventy six shops including petty shops, grocery stores, departmental stores and online stores were surveyed and data was recorded.

PHASE IV - ASSESMENT OF NUTRITIONAL STATUS:

In this phase, nutritional status of Muslim women was assessed with reference to Vitamin D using anthropometric measurements such as height, weight, waist circumference and hip circumference using standard procedures [15] from which BMI (Body mass index) and waist hip ratio was calculated. Clinical signs and symptoms of calcium and Vitamin D deficiency were observed and documented with the help of a check list. The dietary data was collected using a three day recall method and food frequency questionnaire. Two week days and one weekend pattern was used for the 3 day recall data. From the food intake, the mean nutrient intake of the women was calculated and compared with the RDA suggested by ICMR [16].

PHASE V - ASSESSMENT OF VITAMIN D STATUS

Vitamin D and calcium levels were tested in a sub sample of 30 Muslim women. Fully automated Chemi Luminescent Immuno Assay method was adopted to test Vitamin

D was the blood sample. 25 OH Vitamin D was analyzed on Siemens ADVIA Cantaur, standardized against ID-LC/MS/MS, as per Vitamin D Standardization Program (VDSP) [17]. The serum calcium level was estimated using Arsenazo III Assay [18]

PHASE VI - DEVELOPMENT AND IMPLEMENTATION OF INTERVENTION STRATIGIES

YouTube videos, motion graphic videos, memes and recipe idea videos were developed in this phase. A WhatsApp group as a portal to deliver the digital education module and a google form for evaluation of impact was developed. The intervention materials developed covered the topics overview of Vitamin D, sources, importance, dietary Vitamin D, its benefits to women and ideas to increase Vitamin D intake. Two hundred women were divided into three groups as follows:

- Group I (69) - Digital health intervention
- Group II (67) - One to one telephonic counseling and dietary modification
- Group III (63) - Control Group.

PHASE VII - IMPACT EVALUATION

Impact of Intervention was evaluated using a Google for before and after intervention changes in knowledge and practices which included awareness on introduction to Vitamin D, benefits, sources, fortified foods, duration and time spent in sunlight, physical activity, intake of Vitamin D rich foods and fortified foods. Changes in post dietary modification was assessed using 3 day recall method and compared with dietary intake before intervention.

STATISTICAL ANALYSIS

The data collected was recorded, tabulated, consolidated and analyzed using appropriate statistical methods.

CHAPTER IV - RESULTS AND DISCUSSION

- Forty six per cent of the Muslim women were between 20 to 29 years of age, 29 per cent were 30 to 39 yrs of age and the remaining 25 per cent were between 40 to 45 years of age.

- Fifty two per cent of women in the age group of 20 -29 years were graduates, while 51 – 80 per cent of women in the age group of 30 to 39 years and 40 to 45 years were educated only upto primary education levels.
- Sixty five per cent of the Muslim women were housewives, 18 per cent students and the remaining (17%) worked as tailors, teachers, maids, sales and business women. The family income of 79.5 per cent was > Rs.14,500, 17.3 per cent were middle income group and earned Rs.7,301-14,500 (HUDCO 2007) [19] Expenditure pattern showed that the families spent 28 per cent of their income on food followed by rent(14%) and education (10 %).
- Islamic dress was worn by 83 to 96 per cent of the Muslim women. Among the different types of Islamic dress, 34 to 41 per cent of the women wore chaddar in the age group of 30 to 45 years. Thirty six per cent of the women in the age group of 20 to 29 years wore Niqab. Black colour was selected for the Islamic dress by 86 per cent of the women. sunlight exposure and intake of Vitamin D fortified foods showed that Muslim women in all three age groups 20-29 years(61.6%), 30 – 39 yrs(59.1%) and 41 – 45 yrs(34.5%) were exposed to sunlight for less than 20 minutes per day. The time of exposure was predominantly between 11am and 3 pm in all three groups. Fifty Six per cent of the women in 20 -29 yrs, 80.3 per cent in 30 – 39 yrs and 78.2 per cent in 40 -45 yrs age group did not avoid sunlight intentionally, but 31.7 per cent of women between 20 – 29 yrs avoided sunlight to maintain skin complexion. Use of sun blockers was very less in all three groups, among the sunscreen cream and lotion users, 17.3 per cent of women belonging to 20 -29 yrs age group, Umbrella usage was seen in 9.1 per cent women of 40-45 yrs age group.
- In the market survey, Vitamin D fortified foods were identified under the categories milk and milk products, cereals, cooking oil, food supplements, therapeutic supplements, infant formulas, baby foods and glucose powder. The availability of these foods was high (66 to 100%) in departmental stores and online stores compare to petty shops and grocery stores. The upper limit of fortification from the identified Vitamin D fortified foods was 16.5mcg per 100 grams.
- The mean height was below the standard value in women of all three age groups, while weight and BMI was above the standard value in women between 30 t0 39

years (+15.1, +7.05) and 40 to 45 years (+ 14.5, +7.1). Thirty three per cent of the Muslim women between 20 to 29 years were in normal BMI category according to Asian Criteria [20]. Women between 30 to 39 years (37.9%) and 40 to 45 years (34.5 %) were in Type I obesity category. Waist hip ratio of 69 to 76 per cent of the women was in high risk category.

- Clinical signs and symptoms showed 55 to 60 per cent of Muslim women in all three age groups had hair loss. Leg pain (65.5%) and fatigue (34.5%) was predominant in women between 40 to 45 years of age. Depression and PMS(pre menstrual syndrome) were high between 34 to 40 per cent in women between 20 to 29 years and 40 to 45 years.
- Cereals and animal food intake was above higher than the recommended allowences, while pulses, green leafy vegetables, roots and tubers, other vegetables, fruits and milk and milk products intake was lower than ICMR recommendations [21] among the Muslim women of all three age groups. Fats and oils and milk and milk product intake was moderately high, which was consumed in the form of tea or coffee, 4 to 5 times a day. Energy, proteins, carbohydrates, fats, phosphorus, niacin, vitamin C and Vitamin D_2 intake was above RDA in all three age groups. Fibre, calcium, iron, beta carotene, riboflavin, vitamin B6 and folic acid intake was lower than RDA in all three age groups. Thiamine intake was moderate in Muslim women between 40 to 45 years of age and lower than RDA in the other two age groups.
- Ninety three per cent were found to be Vitamin D deficient and 6.7 per cent were insufficient, none of the women showed sufficient levels of Vitamin D. The mean Vitamin D level and standard deviation was 9.53 ± 3.98. Calcium levels of all the Muslim women was in the normal range and the mean calcium level and standard deviation was 9.33 ± 0.38. Levels of Vitamin D had a positive association with type of dress, colour of dress, Leg pain and intake of fortified foods was significant at $p<0.05$. Sunlight exposure was strongly associated with Vitamin D levels($p<0.01$). Vitamin D levels and Vitamin D intake showed a low positive association. Since, a major portion of Vitamin D intake was in the D_2 forms. This indicated low bioavailability of Vitamin D_2 and requirement of large amount of consumption for moderate increase in Vitamin D levels.

- Effect of intervention on awareness was significant in both digital health intervention group (Group I) and one to one telephonic counseling with dietary modification group (Group II) at $p<0.01$ in comparison with the control group in all the three age groups. But the mean differences before and after intervention in Group I among the Muslim women between 20 – 29 years was -6.73, in 30 – 39 years -7.63 and in 40 to 45 years -8.0 which was higher in competition with Group II were the differences were -3.88, -5.2 and -4.72 respectively.
- Effect of intervention on behavior such as physical activities, extent of covering when outdoor, time and duration of sunlight exposure before and after intervention showed significant ($p<0.01$) difference in Group I in all three age groups but in Group II only in Women between 20 – 29 yrs and 30 – 39 yrs. Mean difference in behavior before and after intervention did not reveal any difference in the Group I and II. In the age group of 30 – 39 years higher difference of -3.5 indicated better acceptance among these women.
- Effect of dietary modification on food intake showed significant decrease in cereals, sugar and increase in green leafy vegetables and other vegetables intake among Muslim women between 20 to 29 years of age. In 30 – 39 years green leafy vegetables , other vegetables, roots and tubers and fruits intake increased significantly, while in women between 40 – 49 years roots and tubers intake increased but fats and oils and sugar intake decreased significantly.
- Effect of dietary modification on nutrient intake showed a significant increase in proteins, phosphorous and riboflavin intake in women between 20 to 29 years. In 30 – 39 years proteins, phosphorous, beta carotene, thiamine, riboflavin, vitamin C and Vitamin D_2 intake increased significantly, In women between 40 – 49 years calcium, beta carotene, riboflavin and Vitamin D_2 intake increased significantly.

CHAPTER V - SUMMARY AND CONCLUSION

- Background of Muslim women between 20 to 45 years living in areas of dense Muslim population in Coimbatore city was studied.
- 76 shops were surveyed on availability of Vitamin D fortified foods in the local market

- Vitamin D and calcium nutriture of the Muslim women was assessed through anthropometry, clinical examination, diet survey and biochemical assessment
- Muslim women were divided into three groups - Group I (digital health intervention), Group II (one to one telephonic counseling with diet modification and Group III (control) and impact was evaluated using aptitude test and 3 day recall method.
- Associated factors namely low levels of education upto primary levels (51 to 80%) in women between 30 to 45 years, 65 per cent being house wives, 83.6 to 96.2 per cent of women covered, while going outdoor less than 20 minutes time outdoor in 39 to 61 per cent of the women and lack of awareness (58 to 78%) on Vitamin D were identified which may cause Vitamin D deficiency
- Vitamin D intake was high but a large portion of it was in D_2 forms with a low positive correlation between dietary Vitamin D intake and serum levels of vitamin D, hence large quantities of D_2 intake causes small increase in vitamin D levels.
- Further vitamin D fortified foods were available in all types of shops, but primarily fortification was in D_2 forms and low amount of fortification was observed proving them to be less effective as a source of vitamin D
- High rate of women in pre obese (21 to 34%) categories can lead to further increase in risk of deficiency
- Sunlight exposure and extent of covering with Islamic dress had positive effect on Vitamin D levels
- Before and after nutrition education showed significant difference in the participants awareness and behavior on Vitamin D in Groups I and II
- Digital education was found to be more effective than one to one telephonic counseling.
- Pulses, fruits, green leafy vegetable, roots and tubers and other vegetable intake increased after dietary modification
- Dietary intake of protein, riboflavin and Vitamin D_2 increased after dietary modification and not much difference in D_3 intake was found.

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